L Number	Hits	Search Text	DB	Time stamp
27	149	conver$5 near10 pixel adj5 lumin$8 same (level$1 or up or upper or low or low$4 or high or high$3)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 14:23
28	68	pixel adj5 lumin$8 same (level$1 or up or upper or low or low$4 or high or high$3) same conver$5 and (print$4 and (display$4 or monitor or screen)) and (gray or grey or monochrome or half adj tone or (black and white))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 14:24
30	1	conver$5 near10 pixel adj5 lumin$8 same (level$1 or up or upper or low or low$4 or high or high$3) same (print$4 and (display$4 or monitor or screen)) and (gray or grey or monochrome or half adj tone or (black and white)) same (level$1 or up or upper or low or low$4 or high or high$3)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 14:27
31	1	conver$5 same pixel adj5 lumin$8 same (level$1 or up or upper or low or low$4 or high or high$3) same (print$4 and (display$4 or monitor or screen)) and (gray or grey or monochrome or half adj tone or (black and white)) same (level$1 or up or upper or low or low$4 or high or high$3)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 14:28
29	24	conver$5 near10 pixel adj5 lumin$8 same (level$1 or up or upper or low or low$4 or high or high$3) same conver$5 and (print$4 and (display$4 or monitor or screen)) and (gray or grey or monochrome or half adj tone or (black and white))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 14:31
34	3	"6539111"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 15:39
-	2631	luminance near10 (level$1 and conver$5)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:42
-	699	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:42
-	87	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5)) and printer and display	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:42
-	0	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5)) and printer and display and "5581375"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:43
-	0	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5)) and printer and display and "5740333"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:43
-	0	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5)) and printer and display and "5680230"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:43

-	0	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5)) and printer and display and "5045967"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:43
-	64	"5581375" or "5045967" "5740333" or "5680233"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:44
-	0	("5581375" or "5045967" "5740333" or "5680233") and (luminance near10 (level$1 and conver$5))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:44
-	11	("5581375" or "5045967" "5740333" or "5680233") and luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:44
-	2	("5581375" or "5045967" "5740333" or "5680233") and luminance near3 level$1	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:45
-	4836	luminance adj level$1	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:48
-	1041	luminance adj level$1 same (conver$5)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:45
-	179	luminance adj level$1 same (conver$5 and adjust$6)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:45
-	64	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:46
-	13	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))and printer	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:46
-	6	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))and printer and display	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:47
-	3	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))and printer and display and captur$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:47
-	5	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))and printer and display and (ccd or camera or captur$3)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:48
-	0	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))and printer and display and (ccd or camera or captur$3)and epson	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:48

-	35	luminance adj level$1 and epson	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:55
-	1	luminance adj level$1 and epson near4 research	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:49
-	1	luminance adj level$1 and epson near4 research and captur$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:49
-	1	luminance adj level$1 and epson near4 research and captur$3 and data adj convert$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:51
-	2	luminance adj level$1 same (captur$3 adj unit and data adj convert$3 and color adj assign$6)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:52
-	22	luminance adj level$1 same (captur$3 adj unit and data adj convert$3 and color adjand bright$4 and pixel$1 and assign$6)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:53
-	5	luminance adj level$1 same (captur$3 adj unit and data adj convert$3 and color adjand bright$4 and pixel$1 and assign$6) and print$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:53
-	5	luminance adj level$1 same (captur$3 adj unit and data adj convert$3 and color adjand bright$4 and pixel$1 and assign$6) and print$3 and display$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:53
-	10	luminance adj level$1 and color adj assignment	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:56
-	3	luminance adj level$1 and color adj assignment and conver$5 near10 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:57
-	5	luminance adj level$1 and color same assignment near10 (pixel$1 or luminance) and conver$5 near10 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:58
-	20	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:14
-	15	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:17
-	8893	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 abd brightness near20 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:18

-	2	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 and brightness near20 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:18
-	2	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 and brightness near50 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:18
-	14	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 and brightness	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:23
-	14	(luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4) and (luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 and brightness)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:19
-	3	(luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4) and (luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 and brightness) and 345/$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:19
-	19	(bright$6 or luminance) adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:23
-	25	(bright$6 or luminance) near4 level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:24
-	419	(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:25
-	227	(conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near10(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:26
-	163	(conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near6(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:28
-	172	(conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near6(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7 or index$3 or address$5) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:28

-	17	(conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near6(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7 or index$3 or address$5) near10 (pixel$1 or luminance or color$1 or bright$6) near10 conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:29
-	2	(conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near6(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7 or index$3 or address$5) near10 (pixel$1 or luminance or color$1 or bright$6) near10 conver$5 near10 (bright$6 or luminance) and print$4 and epson	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:30
-	2	((conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near6(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7 or index$3 or address$5) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4) and epson	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:30
-	7	((bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4) and epson	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:30
-	3	"6539111" and luminance andcolor and weight$4 and values	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/08 20:01
-	3	"6539111" and luminance and color and weight$4 and values	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/08 20:01
-	1	"4488245" and camera and luminance and color and weight$4 and values and print$3 and conver$5 and rgb and scan$4 and pixel$1 and luminous and chroma$8	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/08 20:03

L Number	Hits	Search Text	DB	Time stamp
27	149	conver$5 near10 pixel adj5 lumin$8 same (level$1 or up or upper or low or low$4 or high or high$3)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 14:23
28	68	pixel adj5 lumin$8 same (level$1 or up or upper or low or low$4 or high or high$3)same conver$5 and (print$4 and (display$4 or monitor or screen))and (gray or grey or monochrome or half adj tone or(black and white))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 14:24
30	1	conver$5 near10 pixel adj5 lumin$8 same (level$1 or up or upper or low or low$4 or high or high$3)same (print$4 and (display$4 or monitor or screen))and (gray or grey or monochrome or half adj tone or(black and white))same (level$1 or up or upper or low or low$4 or high or high$3)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 14:27
31	1	conver$5 same pixel adj5 lumin$8 same (level$1 or up or upper or low or low$4 or high or high$3)same (print$4 and (display$4 or monitor or screen))and (gray or grey or monochrome or half adj tone or(black and white))same (level$1 or up or upper or low or low$4 or high or high$3)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 14:28
29	24	conver$5 near10 pixel adj5 lumin$8 same (level$1 or up or upper or low or low$4 or high or high$3)same conver$5 and (print$4 and (display$4 or monitor or screen))and (gray or grey or monochrome or half adj tone or(black and white))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 14:31
34	3	"6539111"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/09 15:39
-	2631	luminance near10 (level$1 and conver$5)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:42
-	699	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:42
-	87	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5)) and printer and display	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:42
-	0	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5)) and printer and display and "5581375"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:43
-	0	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5)) and printer and display and "5740333"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:43
-	0	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5)) and printer and display and "5680230"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:43

-	0	luminance near10 (level$1 and conver$5 and (calculat$6 or interpolat$5)) and printer and display and "5045967"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:43
-	64	"5581375" or "5045967" "5740333" or "5680233"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:44
-	0	("5581375" or "5045967" "5740333" or "5680233") and (luminance near10 (level$1 and conver$5))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:44
-	11	("5581375" or "5045967" "5740333" or "5680233") and luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:44
-	2	("5581375" or "5045967" "5740333" or "5680233") and luminance near3 level$1	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:45
-	4836	luminance adj level$1	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:48
-	1041	luminance adj level$1 same (conver$5)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:45
-	179	luminance adj level$1 same (conver$5 and adjust$6)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:45
-	64	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:46
-	13	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))and printer	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:46
-	6	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))and printer and display	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:47
-	3	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))and printer and display and captur$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:47
-	5	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))and printer and display and (ccd or camera or captur$3)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:48
-	0	luminance adj level$1 same (conver$5 and adjust$6 and (assign$7 or select$7))and printer and display and (ccd or camera or captur$3)and epson	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:48

-	35	luminance adj level$1 and epson	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:55
-	1	luminance adj level$1 and epson near4 research	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:49
-	1	luminance adj level$1 and epson near4 research and captur$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:49
-	1	luminance adj level$1 and epson near4 research and captur$3 and data adj convert$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:51
-	2	luminance adj level$1 same (captur$3 adj unit and data adj convert$3 and color adj assign$6)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:52
-	22	luminance adj level$1 same (captur$3 adj unit and data adj convert$3 and color adjand bright$4 and pixel$1 and assign$6)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:53
-	5	luminance adj level$1 same (captur$3 adj unit and data adj convert$3 and color adjand bright$4 and pixel$1 and assign$6) and print$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:53
-	5	luminance adj level$1 same (captur$3 adj unit and data adj convert$3 and color adjand bright$4 and pixel$1 and assign$6) and print$3 and display$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:53
-	10	luminance adj level$1 and color adj assignment	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:56
-	3	luminance adj level$1 and color adj assignment and conver$5 near10 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:57
-	5	luminance adj level$1 and color same assignment near10 (pixel$1 or luminance) and conver$5 near10 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/22 17:58
-	20	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:14
-	15	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:17
-	8893	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 abd brightness near20 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:18

-	2	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 and brightness near20 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:18
-	2	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 and brightness near50 luminance	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:18
-	14	luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 and brightness	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:23
-	14	(luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4) and (luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 and brightness)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:19
-	3	(luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4) and (luminance adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 luminance and print$4 and brightness) and 345/$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:19
-	19	(bright$6 or luminance) adj level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:23
-	25	(bright$6 or luminance) near4 level$1 and color same assignment same (pixel$1 or luminance or color$1) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:24
-	419	(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:25
-	227	(conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near10(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:26
-	163	(conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near6(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:28
-	172	(conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near6(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7 or index$3 or address$5) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:28

-	17	(conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near6(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7 or index$3 or address$5) near10 (pixel$1 or luminance or color$1 or bright$6) near10 conver$5 near10 (bright$6 or luminance) and print$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:29
-	2	(conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near6(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7 or index$3 or address$5) near10 (pixel$1 or luminance or color$1 or bright$6) near10 conver$5 near10 (bright$6 or luminance) and print$4 and epson	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:30
-	2	((conver$6 or correct$5 or threshold or reduc$6 or error or distortion)near6(bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7 or index$3 or address$5) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4) and epson	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:30
-	7	((bright$6 or luminance) near4 level$1 and color same (select$8 or assign$7) same (pixel$1 or luminance or color$1 or bright$6) and conver$5 near10 (bright$6 or luminance) and print$4) and epson	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/01/24 14:30
-	3	"6539111" and luminance andcolor and weight$4 and values	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/08 20:01
-	3	"6539111" and luminance and color and weight$4 and values	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/08 20:01
-	1	"4488245" and camera and luminance and color and weight$4 and values and print$3 and conver$5 and rgb and scan$4 and pixel$1 and luminous and chroma$8	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/08 20:03

Detailed Description Text - DETX (21):

As shown in FIG. 4, Red, Green, and Blue (RGB) color-pixel data from dithering engine 204 are provided as input to mode selecting circuit 403 wherein each pixel consists of 4 Red data bit Red data, 4 Green data bits, and 4 Blue data bits. Mode selecting circuit 403 also receives mode select signal FRCLEVEL[1:0] which indicates whether 2-, 4-, 8-, or 16-levels of gray scaling is desired. Depending on the value of mode select signal FRCLEVEL[1:0], mode selecting circuit 403 passes selected RGB color-pixel data to its output according to a predetermined scheme. Referring now to Table 1 which illustrates the scheme implemented by mode selecting circuit 403 in the current embodiment.

Detailed Description Text - DETX (31):

In accordance to present invention, the display area is divided into tiles wherein each tile has a predetermined dimension of 16.times.16 pixels. It is to be appreciated that the display area can be divided into tiles of any size. Reference is now made to FIG. 5 illustrating, as an example, a 640.times.480 pixels display area that is divided into tiles in accordance to the present invention. As shown in FIG. 5, the tiles are numbered sequentially from left to right along each row and from top to bottom along each column.

Detailed Description Text - DETX (67):

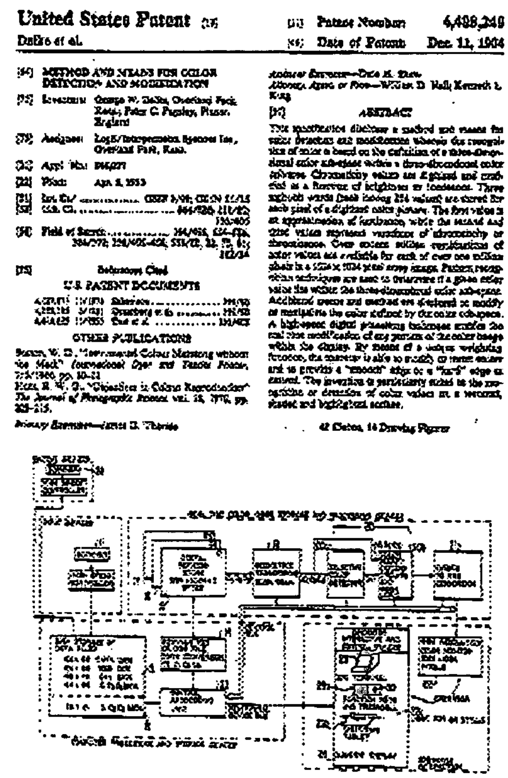
Turning now to FIG. 10 there is shown image 1002 created from physical data. For example, image 1002 can be a frame from a sequence of television frames. Or, for example, image 1002 can be one frame from a photographic movie film, or image 1002 can be a presentation on a cathode ray screen of radar data collected during air traffic control operations, or further, image 1002 can be a presentation in a military viewer showing a target for the purpose of aiming a weapon at the target, etc. In all cases, image 1002 is presented as discrete pixels 1006. Pixels 1006, may for example, be black and white presentations with a scale of gray with a chosen number of levels of scale of gray, such as 8 levels, 16 levels, 32 levels, etc. Alternatively, pixels 1006 may be color representations of an image, and can have a number of bits assigned in each pixel for the representation of primary colors in order to generate a color image on a television screen, a computer screen, etc.

Detailed Description Text - DETX (116):

Input and output interface card 22,020 (I/O card) provides an interface between computer bus 22,002 and input and output devices which gather data from the outside world, or generate an output which affects the outside world. Input and output devices include the monitor 22,022 of the computer on which the CPU 22,004 writes information, a printer (not shown, could also be on network 22,012) on which CPU 22,002 prints information, a mouse 22,024 for a

Brief Summary Text - BSTX (29):

U.S. Pat. No. 4,258,385 to Greenberg et al, issued on Mar. 24, 1981, discloses an interactive editing system for video production. The video signals are broken into RGB memory planes, and may be altered on a pixel-by-pixel basis by the generation of a physical or electronic mask. The area within the mask may then be altered and then recombined with the original image. The electronic mask is generated on the x.y physical axis of the image by a track ball, digitizing table, or a keyboard. The physical mask is scanned by a camera and converted to an electronic mask.



Detailed Description Text - DETX (6):

Referring now to FIG. 3, the adaptive error diffusion stage or system 16 is represented by the dotted lines surrounding the various components located between the input super pixel scanner stage 10 and the output color or monochromatic printer stage 18. The adaptive error diffusion system 16 includes an input summing and memory stage 66 which is connected to receive sub-super pixel data via one input 68 from the scanner 10 and is operative to sum and store all gray scale values within each sub-super pixel (22 in FIG. 2) within each larger super pixel 20. Output data from the summing and memory stage 26 is applied via line 70 as an input to a second summing stage 72 wherein all of the summed sub-super pixel information actually scanned by the scanner 10 is generated on output line 74 and applied to a divider stage 76. The divider stage 76 is operative to divide the summed output data, S, on line 74 into discrete gray table and gray level data, G, on line 78 which is applied as shown by way of an output line 80 to an adjustment control stage 82 to be described in further detail below. This gray level data, G, will, or example, be within one of the 16 or 32 subdivided levels of a gray table representing and digitizing the entire 256 levels of the well known gray scale.

Detailed Description Text - DETX (7):

The summed data, S, and the gray level data, G, are additionally applied

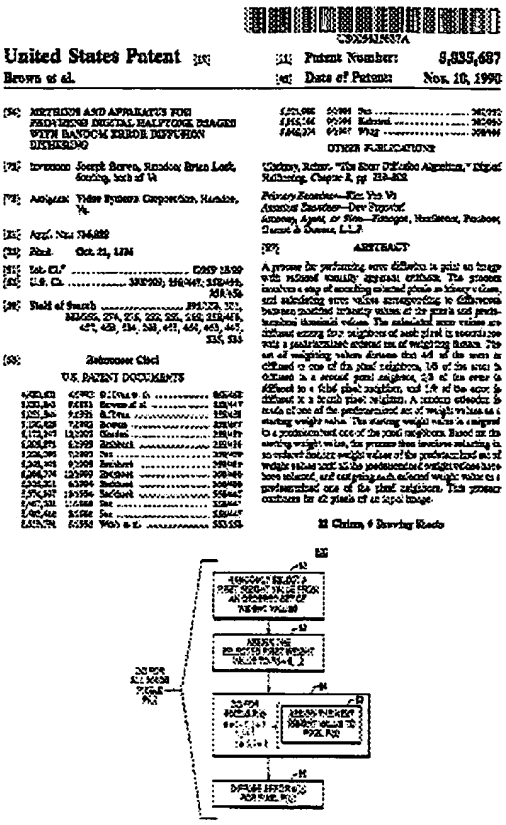
[EAST Browser: L139: (7 print43 same) | DB: US-PGPUB,USPAT,USOCR | Plur: YES | Op: ADJ | Thes: | Doc: 2/7 | Format: KWIC]

File Edit View Tools Window Help

Brief Summary Text - BSTX (8):

Other techniques attempt to convert gray image to binary or lesser level gray while attempting to preserve gray density of the images. One such technique, called error diffusion, attempts to maintain gray density by making the conversion from gray pixels to binary or other lower level pixels on a pixel-by-pixel basis. This procedure involves comparing each pixel with a threshold value, and forwarding the difference to neighboring pixels in a selected group, in accordance with a weighting scheme. In this manner all errors can be distributed and accounted for in the conversion process. It is therefore critical that an appropriate weighting scheme be selected that can both accommodate complex image information and process the image information in real-time, as required by today's image processing applications.

Details | Text | Image | HTML | KWIC



United States Patent [19]
Brown et al.

[11] Patent Number: 5,335,687
[45] Date of Patent: Nov. 10, 1992

[54] METHOD AND APPARATUS FOR PERFORMING DIGITAL HALFTONE IMAGES WITH RANDOM ERROR DIFFUSION

[75] Inventors: Joseph Brown, Brandon Brian Lock, Sterling, both of Va

[73] Assignee: Xerox Systems Corporation, Herndon, Va.

[21] Appl. No.: 754,888

[22] Filed: Oct. 21, 1991

[51] Int. Cl.[5] H04N 1/40

[52] U.S. Cl. 358/455; 358/447; 358/448; 358/456

[58] Field of Search 358/455, 456, 447, 448, 451, 452, 453, 454, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 535, 536

[56] References Cited
U.S. PATENT DOCUMENTS

OTHER PUBLICATIONS

Cochran, Robert, "The Heart Of Color Separation," Digital Publishing, Chapter 8, pp. 123-132.

Primary Examiner—Eric Yen Vo
Assistant Examiner—Dov Popovici
Attorney, Agent, or Firm—Finnegan, Henderson, Farabow, Garrett & Dunner, L.L.P.

[57] ABSTRACT

A process for performing error diffusion in print on image with reduced visually apparent artifacts. The process involves a step of encoding selected pixels as binary values, and calculating error values corresponding to differences between quantized intensity values of the pixels and predetermined threshold values. The calculated error values are diffused among four neighbors of each pixel to encode pixels with a predetermined ordered set of weighting factors. The set of weighting values decreases from left to right in the order as diffused to one of the pixel neighbors, 1/8 of the error is diffused to a second pixel neighbor, 3/8 of the error is diffused to a third pixel neighbor, and 1/4 of the error is diffused to a fourth pixel neighbor. A random selector is made of one of the predetermined set of weight values as a starting weight value. The starting weight value is assigned to a predetermined one of the pixel neighbors. Based on the starting weight value, the process then involves selecting to ordered distinct weight values of the predetermined set of weight values such as the predetermined weight values have been selected, and assigning each selected weight value to a predetermined one of the pixel neighbors. This process continues for all pixels of an input image.

11 Claims, 4 Drawing Sheets

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File Edit View Tools Window Help

Summary of Invention Paragraph - BSTX (19):

[0017] Preferably, the data converter comprises a luminance calculator for converting the color data for each pixel to first luminance data representing one of a first number of luminance levels, and a gray level processor for further converting the first luminance data for each pixel to second luminance data representing one of the plurality of luminance levels, the plurality being a second number smaller than the first number. This method further reduces, for example, 256 luminance levels to 8 levels, thereby simplifying color assignment.

Summary of Invention Paragraph - BSTX (20):

[0018] Preferably, the gray level processor comprises a distribution calculator for calculating a luminance distribution by counting for each luminance level of the first number the number of pixels whose corresponding luminance data represents that luminance level, and for detecting one or more luminance levels that represent local pixel count minimums in the luminance distribution; and threshold value selecting means for setting threshold values based on the one or more minimums. The gray level processor is adapted to reduce the first number of luminance levels to the second number based on the threshold values. A print image accurately reflecting the brightness of the source image can thus be created by using the luminance levels near these

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data representing one of the plurality of luminance levels, the plurality being a second number smaller than the first number. This method further reduces, for example, 256 luminance levels to 8 levels, thereby simplifying color assignment.

Summary of Invention Paragraph - BSTX (20):

[0018] Preferably, the gray level processor comprises a distribution calculator for calculating a luminance distribution by counting for each luminance level of the first number the number of pixels whose corresponding luminance data represents that luminance level, and for detecting one or more luminance levels that represent local pixel count minimums in the luminance distribution; and threshold value selecting means for setting threshold values based on the one or more minimums. The gray level processor is adapted to reduce the first number of luminance levels to the second number based on the threshold values. A print image accurately reflecting the brightness of the source image can thus be created by using the luminance levels near these transition points as the threshold values for reducing the number of luminance levels.

Summary of Invention Paragraph - BSTX (21):

[0019] Preferably, the distribution calculator is adapted to smooth the luminance distribution, and to detect the one or more minimums from the

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Detail Description Paragraph - DETX (16):

[0075] The source data capturing unit 11 is a file reading controller, scanner, or similar device for capturing as source data full-color image or other image data from which the print data is to be generated. The capturing may be scanning an image or reading an image stored on an external disk, a CD-ROM, a memory card, or other storage device or medium. The source data is then stored in the source data memory 21 as color data (RGB color data or CMYK color data). Such stored source data stored is read pixel-by-pixel by the read/write controller 16, and is transferred to the luminance calculator 17. As further described below, the luminance calculator 17 calculates (that is, converts a color value to a luminance value) a single luminance value for the plural color values defining each pixel, and stores the result. Thus, the source data (color data) in which each pixel is defined by RGB (or CMYK) color intensity values is converted to luminance data in which each pixel is defined by one of a plurality of luminance levels or gray levels. The luminance data stored for each pixel is further converted by the gray level processor 18 to luminance data on a scale with even fewer levels. The gray level processor 18 is further described below. The scale-reduced luminance data output by the gray level processor 18 is stored in the luminance data memory 22 in memory unit 20.

Detail Description Paragraph - DETX (17):

Detail Description Paragraph - DETX (17):

[0076] The luminance data so obtained and then further stored in the memory unit 20 is read by the color assignment unit 13, which then assigns a specific color to each pixel according to its luminance level. Operation of the color assignment unit 13 is also described in more detail below. The source data to which colors have been assigned by the color assignment unit 13 is then stored as print data in the print data memory 23. This stored print data is output by the print data output controller 24 as a logo data file or as print data to the printer, for example, or to another converter or processor (not shown in the figure) for conversion from RGB color data to CMYK color data, for example.

Detail Description Paragraph - DETX (18):

[0077] The parameter input controller 12 enables inputting data for setting the parameters and conditions (referred to below as the parameter data) of certain processing operations, including the threshold values used by the gray level processor 18 for reducing the number of luminance levels of the luminance data to a smaller number of luminance levels, and those used for the color assignments of the color assignment unit 13. Controller 12 also passes the input parameter data to the gray level processor 18 or color assignment unit 13.

Detail Description Paragraph - DETX (29):

[0085] A conversion process whereby the gray level processor 18 reduces the number of luminance levels is described next with reference to FIG. 3, which is a functional block diagram of a gray level processor 18 according to a preferred embodiment of the invention. It is assumed here that the luminance calculator 17 has converted RGB color data to 256-level luminance data. The number of luminance levels is preferably further reduced to facilitate color assignment. The gray level processor 18 therefore reduces this 256-level luminance data to fewer levels, specifically 8 levels in this example.

Detail Description Paragraph - DETX (30):

[0086] It will be noted that this step of further reducing the number of luminance levels is not required if, for example, the luminance calculator 17 has already reduced the source data image to 8 luminance levels by applying equation (3) above. However, if the luminance calculator 17 initially reduces the image to 8 luminance levels using simple division, it is difficult to achieve the subtle gradients that better match the luminance distribution (i.e., the number of pixels per luminance level) in the source image. However, if the image is first converted with high luminance resolution and is then reduced to a lower resolution, the final gradations will better represent the luminance distribution of the source image. If the source image is first converted to luminance data using fine gradations (such as 256 levels), for

assignment. The gray level processor 18 therefore reduces this 256-level luminance data to fewer levels, specifically 8 levels in this example.

Detail Description Paragraph - DETX (30):

[0086] It will be noted that this step of further reducing the number of luminance levels is not required if, for example, the luminance calculator 17 has already reduced the source data image to 8 luminance levels by applying equation (3) above. However, if the luminance calculator 17 initially reduces the image to 8 luminance levels using simple division, it is difficult to achieve the subtle gradients that better match the luminance distribution (i.e., the number of pixels per luminance level) in the source image. However, if the image is first converted with high luminance resolution and is then reduced to a lower resolution, the final gradations will better represent the luminance distribution of the source image. If the source image is first converted to luminance data using fine gradations (such as 256 levels), for example, the luminance distribution can be determined with high resolution. The luminance data can then be reduced to fewer (low resolution) gradations based on threshold values determined from the luminance distribution. By thus converting a full-color image to a low resolution gray scale image, the actual luminance distribution of the source image can be better reflected in the color assignments of the print data.

Detail Description Paragraph - DETX (31):

[0087] The gray level processor 18 shown in FIG. 3 sequentially counts the number of pixels in each luminance level, compares each pixel count with those at the luminance levels before and after the level of the respective pixel count to detect one or more minimums in the luminance distribution curve, and uses these minimums as the threshold values for color assignment. To achieve this, the gray level processor 18 tabulates the pixel count for each luminance level in the image, i.e., calculates the luminance distribution, and detects the minimums used as the threshold value from the distribution curve.

Detail Description Paragraph - DETX (32):

[0088] This process could be skipped and the threshold values determined by evenly dividing the luminance levels obtained from the luminance calculator 17, and the image then converted to a low resolution gray scale image using these threshold values. However, the threshold values obtained by such even division will not accurately reflect the change in luminance that is characteristic of the source data, and the pattern of the resulting print image may be completely different from the source image. It is therefore desirable to determine the threshold values characteristic of the image by first analyzing the luminance distribution of the source image. The gray level processor 18 is further described below.

Detail Description Paragraph - DETX (63):

[0119] If searching for the threshold values is selected (S202 returns yes), the number of pixels of each luminance level in the image is counted to determine the distribution of pixels among the luminance levels in the image (S203). The resulting luminance distribution is preferably smoothed as has been explained above. Minimums meeting specific conditions are then detected from the luminance distribution (S204). It should be noted that these minimums can be detected by finding luminance levels where the pixel count stops decreasing and begins increasing such as described above, or using other methods that will be apparent to one skilled in the art. Valleys without a specific size and depth, and valleys having more than a specified number of pixels in the distribution curve, can be omitted from use as a local minimum. This minimum detection step (S204) is further described in detail below.

Detail Description Paragraph - DETX (64):

[0120] After the minimums in the distribution have been detected, the threshold values are defined based on the luminance levels of the detected minimums (S205). As previously noted, the luminance levels of the minimums can be used directly as the threshold values, or these levels can be processed in some way to determine the threshold values. Once the threshold values are determined, the luminance data is converted to fewer luminance levels (8 in this example) based on the threshold values (S206).